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A CRETACEOUS PALM BRUCHID, *MESOPACHYMERUS ANTIQUA*, N. GEN., N. SP. (COLEOPTERA: BRUCHIDAE: PACHYMERINI) AND BIOGEOGRAPHICAL IMPLICATIONS

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Abstract.—***Mesopachymerus antiqua*** (Coleoptera: Bruchidae), a new genus and species of palm seed beetles, is described from Cretaceous Canadian amber. The new genus is characterized by its small size (under 3 mm in length with head deflexed), head prolonged into a short beak, coarse eye facets, non-existent ocular sinus, complete pronotal carina, pro- and metatarsi segment 1 well expanded at apices, metafemur incrassate, pecten with 6 denticles, prepectenal ridge with 8 spines and with the denticles and spines offset when the leg is flexed and metatibia positioned on the lateral side of the pecten and on the mesal side of the prepectenal spines. Based on this fossil, it is proposed that the Bruchidae arose in the Nearctic during the Jurassic or Early Cretaceous and then migrated to the Palearctic over the Beringia land bridge before the Oligocene. Movement into South America could have occurred at the end of the Cretaceous when the Proto-Greater Antilles formed a land bridge connecting North and South America. Palm seeds are suggested to be the ancestral hosts of the Bruchidae.

Key Words: *Mesopachymerus,* new genus, *Mesopachymerus antiqua,* new species, Bruchidae, Canadian amber, Cretaceous

A beetle in Canadian amber that was originally considered to be a sagrine chrysomelid (Poinar 1999a) was re-examined and determined to be a pachymerine bruchid. The amber piece containing the fossil bruchid originated from deposits of subbituminous coals and associated shales in Grassy Lake, Alberta, Canada. The amber sediments belong to the Foremost Formation (Judith River Formation) within the Campanian of the Upper Cretaceous. These deposits were originally radiometrically dated between 70 and 80 million years (Folinsbee et al. 1964) and more recently by Eberth and Hamilton (1993) at 79 million years. The present study describes the fossil in a new genus and discusses its significance regarding the origin of the family Bruchidae and the original host plants of this group.

Materials and Methods

The specimen has been embedded in bioplastic for stabilization and mounted on a microscope slide. While embedding specimens in bioplastic may stabile the amber, it often restricts observations. This specimen, which is essentially complete except for missing portions of some legs, was mounted facing the microscope slide and not the cover slip. Since the bioplastic covers all edges of the slide, the specimen could not be observed from the dorsal, ventral, anterior or posterior sides, which made viewing many important taxonomic characters impossible. Also a milky deposit almost total-

ly covers the cover glass side as well as much of the abdomen and elytra on the viewing left side (Fig. 1). The description is based on characters observed on the head, antennae, pronotum and legs.

Observations and photographs were made with a Nikon stereoscopic microscope SMZ-10R and Nikon Optiphot microscope™ at magnifications up to 600×. All measurements are in microns unless otherwise noted.

Mesopachymerus Poinar, new genus

Description.—Small, under 3 mm in length with head deflexed; head short, prolonged into a short beak; eye facets coarse; ocular sinus apparently non-existent; 11 antennal segments serrate (slide must be tilted to see this character) except scape; pronotal carina complete; protarsus and metatarsus segment 1 well expanded at apex; metafemur incrassate; pecten with 6 blunt tipped denticles; prepectenal ridge with 8 spines; denticles and spines offset when leg flexed; tibia positioned on lateral side of pecten and on mesal side of prepecten; metatibia with at least two carina; metatibia with well-developed mucro and small spur; calcaria absent.

Etymology.–"Meso" is from Mesozoic. The gender is masculine.

Diagnosis.—The non-metallic body and shape of the metafemur separate the specimen from the Rhaebinae. The absence of calcaria and presence of a mucro separates it from the Amblycerinae. The presence of a pecten and a marginal line on the disk of the pronotum separate it from the Bruchinae and place the fossil in the Pachymerinae (Nilsson and Johnston 1993). The absence of deep ocular sinuses and a variegated vestiture separate the specimen from the Caryopemini (Nilsson and Johnson 1993). While the Pachymerini and Caryedontini are obviously closely related, characters on the fossil such as the strongly expanded metatarsal segment 1, the short rostrum, the coarse eye facets, the nonexistent ocular sinus, the structure of the pecten and prepecten, and the complete pronotal carina show its affinity with the Pachymerini.

The shape and size of the denticles on the pecten and the spines on the prepecten, the serrate nature of antennal segments 2–11, the offset nature of the pectenal denticles and prepectenal spines, and the small size separate the new genus from all others in the Pachymerini.

Mesopachymerus antigua Poinar, new species

(Figs. 1–5)

Description.—With characters listed under generic description; small species with body length of 2.77 mm (from frons to tip of abdomen; with head deflexed; if head porrect, then body length of 3.26 mm). Integument dull black; most of body with moderate to heavy pubescence.

Head: Length = 0.60 mm, eye spherical, diameter = 0.23 mm; postocular lobe absent; left antenna outstretched over thorax, antennal segments covered with short hairs and a few long hairs near apices of each segment, antenna 1.45 mm in length, 11 segments serrate except linear scape; right antenna curved under body; maxillary palp 3-segmented, terminal segment long, second segment short; labial palp 2-segmented, both segments short, subequal; short hairs on labrum and clypeus; tuft of recurved, scalelike hairs protruding from tip of labrum.

Thorax: Length = 0.63 mm; pronotum with marginal carina, covered with short hairs; legs brown, covered with short, thick pubescence; left proleg bent under thorax; apex of left femur and base of left tibia missing; apex of protibia with cluster of 11 terminal spines; protarsus with second and third segments bilobed; claws paired, apical half curved, 52 long, with swollen base; metafemur incrassate, 940 in greatest length and 470 in greatest width; ventral side of pecten armed with 6 blunt-tipped denticles, denticle one slightly larger than remainder, closer to femur apex than base, following 4 denticles subequal, denticle 6 smallest; pre-

Fig. 1. Lateral view of *Mesopachymerus antiqua* in Canadian amber. Bar = 554 μm.

pectenal ridge longer than pecten, with series of 8 spines, subequal in length, proximal two wide; metatibia evenly arcuate, with 2 carinae (possibly more).

Abdomen: Length = 2.03 mm, dark, elytra with short hairs, elytra tips cover base of pygidium, length elytra = 1.91 mm, elytra with striations containing punctures; number of striations and punctures obscured by milky deposit; venter with 5 segments.

Female.—unknown

Material examined.—Holotype male in Canadian amber, deposited at the Royal Tyrrell Museum in Drumheller, Alberta, Canada (accession number TMP 91.148.771).

Type locality.—Deposits of subbituminous coals and associated shales in Grassy Lake, Alberta, Canada.

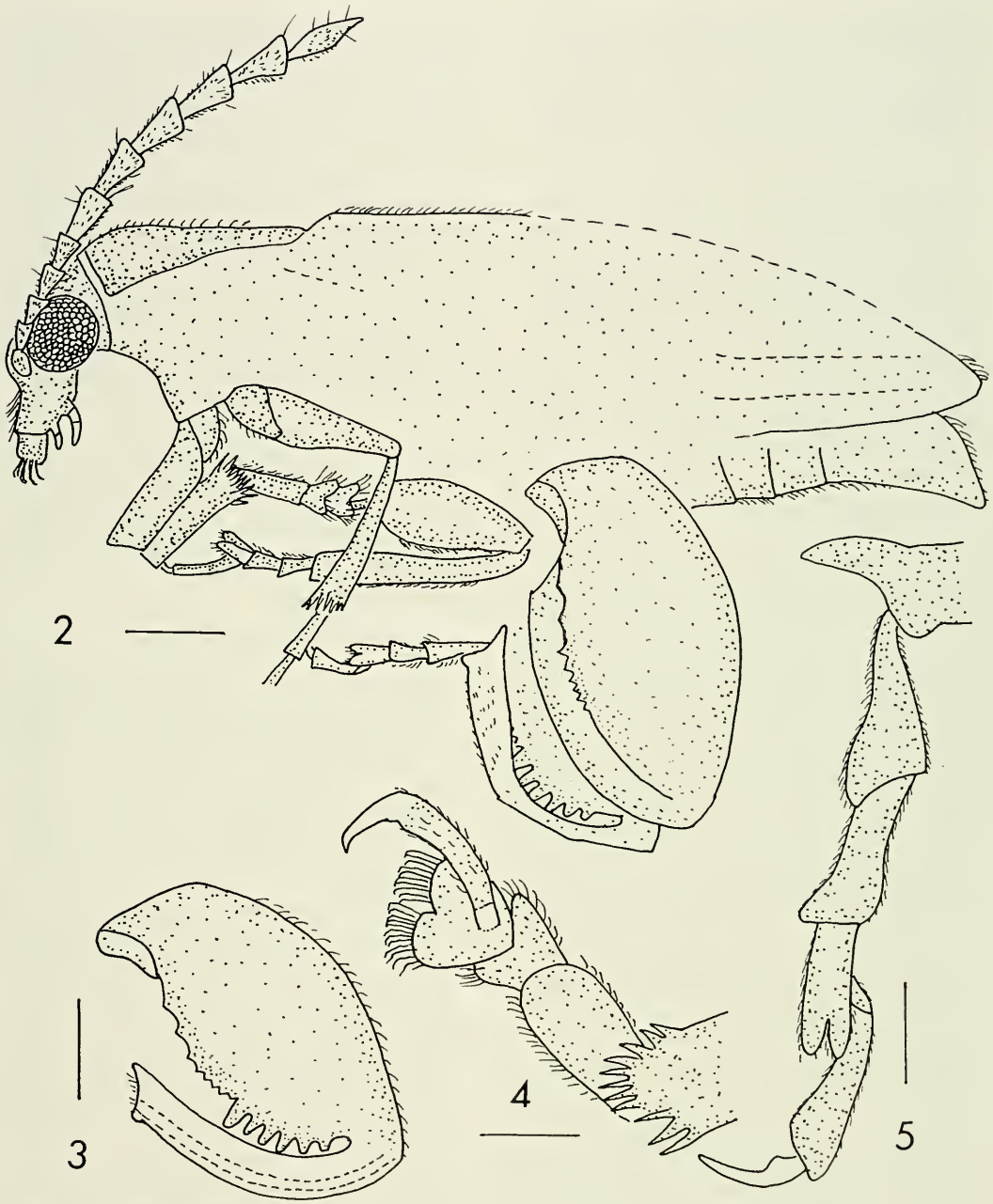
Etymology.—"Antiqua" refers to antique or old.

Comments.—According to Nilsson and Johnson (1993), a widened protarsus 1 is indicative of male palm bruchids. In *M. antiqua,* protarsus 1 is widened and both protarsus 2 and 3 are bilobed and heavily setose (mesotarsus 2 and metatarsus 2 are linear and less setose). The specimen is considered a male and these protarsal modifications would probably have been used for clasping the female.

Diagnosis.—This is the first description of a Mesozoic member of the family Bruchidae and represents the smallest known Pachymerini (Nilsson and Johnson 1993). Previously described fossil palm bruchids include several taxa from the Florissant shales in North America (approximately 35 mya) (Wickham 1914) that were subsequently placed in the fossil genus *Oligobruchus* Kingsolver (1965) and assigned to the tribe Caryopemini (Nilsson 1992) and the pachymerini, *Caryobruchus dominicanus* Poinar (1999b) from Dominican amber. An undescribed specimen from Lower Eocene beds in British Columbia tentatively has been placed in the Caryopemini (Archibald and Mathewes 2000).

Discussion

The present find disputes various theories on the origin of the Bruchidae. The suggestion by Lawrence and Newton (1982) that the Bruchidae evolved during the Tertiary is no longer valid. The hypothesis that



Figs. 2–5. *Mesopachymerus antiqua*. 2, Lateral view of entire specimen. Note that when flexed, the metatibia is positioned on the lateral side of the pectin and on the mesal side of the prepectenal ridge. Bar = 260 μm. 3, Reconstruction of left hind leg with metatibia slightly opened to show pecten and prepectenal ridge. Bar = 243 μm. 4, Left protarsus showing bilobed condition of second and third segments. Bar = 52 μm. 5, Left metatarsus showing basitarsus greatly expanded at apex. Bar = 49 μm.

the Pachymerinae originated in Gondwanaland (Nilsson 1992) is also challenged. An alternative hypothesis is that the Pachymerinae arose in what is now the Nearctic Region in the Late Jurassic or Early Cretaceous when conditions were tropical- subtropical (Boucot et al., in press). During this period, the beetles dispersed into the Palearctic and Asia across the Beringia land bridge, which was present by the Late Cretaceous and continued to be open intermittently throughout the Eocene and into the Oligocene (Lillegraven et al. 1979). The beetles eventually reached Africa in the Miocene when the African plate made contact with Southern Europe (Smith et al. 1994). Another possible migratory route to the Old World could have been via the DeGreer and Thulean land bridges. Migration from North America to South America could have occurred when the Caribbean Plate (Proto-Greater Antilles) made contact with the Chortes terrane (southern Guatemala, Honduras, northern El Salvador and part of Nicaragua) and the Maya terrane (southern Mexico, Belize, and northern Guatemala) some 65 mya (Donnelley 1992). Origin of the Bruchidae in North America is supported by an undescribed specimen from Lower Eocene beds in British Columbia (Archibald and Mathewes 2000) as well as fossil species of *Oligobruchus* Kingsolver from the Florissant shales. The above taxa have been assigned to the tribe Caryopemini that is restricted to the Old World today. The presence of both Pachymerini and Caryopemini in Nearctic Cretaceous and Eocene deposits indicates that several types of seed beetles occurred in the New World by the Eocene. Migration of the Caryopemini into the Old World probably occurred by the end of the Eocene since northern land masses would have been hostile for these forms during the Oligocene when the climate cooled significantly (Prothero 1994).

Since, with one possible spurious exception, the Pachymerini are restricted to developing in palm seeds (Johnson et al. 1995), and it is likely that *M. antiqua* developed in palm seeds. It is proposed here that palm seeds, and not legume seeds (Nilsson 1992), were the original hosts of bruchids. In western North America, there are no records of Cretaceous legumes; however, Upper Cretaceous palm fossils belonging to several genera, including *Sabal,* exist (Tidwell 1998). Many species of *Sabal* are hosts to *Caryobruchus* Schönherr and *Pachymerus* Thunberg species today (Johnson et al. 1995) and a species of *Sabal* could have been the host plant of *M. antiqua.*

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